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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/819,449	03/28/2001	Michael Petrov	02509/70	2720
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KENYON & KENYON ONE BROADWAY NEW YORK, NY 10004			KIM, CHONG R	
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			2623	

DATE MAILED: 10/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/819,449	Applicant(s) PETROV ET AL.	
	Examiner Charles Kim	Art Unit 2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 July 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 11-15 and 27-31 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 5-8, 16, 21-24 and 32 is/are allowed.
- 6) ☒ Claim(s) 1-4, 9, 10, 17-20, 25 and 26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment and Arguments

1. Applicant's amendment filed on July 18, 2005 has been entered and made of record.
2. In view of applicant's amendment, the claim objections are withdrawn.
3. In view of applicant's amendment, the 112 second paragraph rejections are withdrawn.
4. Applicant's arguments, see pages 31-32, with respect to claims 16 and 32 have been fully considered and are persuasive. The rejection of claims 16 and 32 has been withdrawn.
5. Applicant's arguments, see pages 29-31, with respect to claims 1-4, 9-10, 17-20, 25-26 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants argue (page 30) that "Watanabe does not describe revising the perspective projected model so that its vertices fall within a projected silhouette contour." The Examiner disagrees. Watanabe clearly discloses these features at least on pages 4-5, paragraph 53, where it states that "the three-dimensional model is deformed so that vertexes correspond to an outline of the object in the target image..." Note that the vertices of the projected face will fall within the boundaries of the silhouette contour (outline) when it is revised (deformed) to correspond to the contour. Therefore, it appears that Watanabe discloses a "three-dimensional model refining process that includes the steps of projecting each face of an initial three-dimensional model of an object onto a two-dimensional plane of image collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image," as claimed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-4, 9-10, 17-20, 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Matsumoto et al., U.S. Patent No. 6,356,272 ("Matsumoto"), Nishida, U.S. Patent No. 6,424,746 ("Nishida"), and Watanabe et al., U.S. Patent Application Publication No. 2001/0005424 ("Watanabe").

Referring to claim 1, Matsumoto discloses a method for constructing a 3D model of an object comprising the steps of:

a. capturing a series of photographic images of an object using a camera having a planar image collector, where the step of capturing images collects the images of the object from a plurality of different angles, where the angle associated with each image is determined from a pre-selected reference point in three-dimensional space and where from that associated angle it is possible to determine the location in three-dimensional space of the plane of the image collection (col. 15, lines 25-67, col. 16, line 65-col. 17, line 3 and figures 1 and 6);

b. processing each photographic image to identify clusters of pixels in the image that describe the object (col. 17, lines 2-27 and figure 6);

c. tracing the perimeter of each cluster of the pixels in the image that describe the object to gather a set of pixels which describe a silhouette contour of the object's shape, and thereby create a set of silhouette contours (col. 17, lines 2-27 and figure 6).

Matsumoto does not explicitly disclose the step of processing the points of the silhouette contours to select from those points the vertices of a polygon which approximates the silhouette contour of the object's shape, and thereby create a set of silhouette contour polygons. However, this feature was exceedingly well known in the art. For example, Nishida discloses the step of processing points of a silhouette contour to select from those points the vertices of a polygon which approximates the silhouette contour of an object's shape (col. 18, lines 19-41 and figures 8-10).

Matsumoto and Nishida are combinable because they are both concerned with image processing methods for determining a contour image of an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the silhouette contours of Matsumoto so that a polygon which approximates the silhouette contour of the object's shape is created, as taught by Nishida. The suggestion/motivation for doing so would have been to provide a compact expression of the structural features of the contour of the object, thereby enhancing the efficiency of the image processing method. Therefore, it would have been obvious to combine Matsumoto with Nishida.

Matsumoto further discloses the step of creating an initial three-dimensional model of the object using one of the silhouette contours, the three-dimensional model being formed by making a conical projection from one of the set of silhouette contours, creating along the bounds of the conical projection a near and far face for the object model, with the near and far faces each representing a projection of the vertices of the silhouette contour in three-dimensional space (col. 17, line 29-col. 18, line 10 and figures 7-8). In view of the combination described above,

Matsumoto and Nishida disclose an initial three-dimensional model of the object that is based on the projection of one of the silhouette contour polygons.

Matsumoto and Nishida do not explicitly disclose the step of creating additional faces to span volume between the points of the near and far faces based on pairs of adjacent vertices in the near and far faces. However, Official notice is taken that the step of creating additional faces to span volume between the points of two faces based on pairs of adjacent vertices in the two faces was exceedingly well known in the art. Therefore, it would have been obvious to modify the method of Matsumoto and Nishida so that additional faces are created to span volume between the points of the near and far faces based on pairs of adjacent vertices in the near and far faces. The suggestion/motivation for doing so would have been to enhance the appearance of the initial three-dimensional model.

Matsumoto further discloses the step of refining the initial three-dimensional model (col. 18, lines 3-47 and figure 9), but does not explicitly disclose that the refining process includes the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane of image collection for given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour polygons for the given image. However, the steps recited in the claimed refining process is not considered to be patently distinct from Matsumoto's refining process because both refining processes appear to be functionally equivalent. For example, Matsumoto explains that the initial three-dimensional model is refined by a (second) projection of a selected silhouette onto the initial model, wherein any portions of model that do not intersect the volume formed by the second projection are removed (col. 18, lines 10-26 and figure 9). Note that the steps described

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above in Matsumoto's refining process are functionally equivalent to the steps of projecting the initial three-dimensional model onto the two-dimensional plane for the selected silhouette, and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image--both refining processes result in the removal of any portions of the initial three-dimensional model that do not intersect the volume formed by the second projection of the selected silhouette onto the model. The applicant's specification provides further evidence of the functional equivalence described above. For example, on page 62, the applicants state:

“To refine the initial, (rough) 317 model depicted at 690 based on the second silhouette contour polygon 694, the system and method of the present invention uses a procedure (described in further detail below) that in effect projects the initial (rough) 3D model depicted at 690 through a conical projection of the second silhouette 694. The system then adjusts the initial, (rough) 317 model depicted at 690, clipping from the model those areas that do not intersect the volume formed by the second projection.”

Matsumoto clearly discloses these steps for his refining process (col. 18, lines 3-47 and figure 9). Accordingly, it appears that the results of Matsumoto's refining process are equivalent to the results of the claimed refining process, and therefore, the two refining processes are not considered patently distinct.

Despite the functional equivalence between the two refining processes, the Examiner notes that Matsumoto and Nishida still do not explicitly disclose the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane of image

collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour polygons for the given image. However, these features were exceedingly well known in the art. For example, Watanabe discloses a three-dimensional model refining process that includes the steps of projecting each face of an initial three-dimensional model of an object onto a two-dimensional plane of image collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image (page 4, paragraphs 43, 53 and page 5, paragraph 58).

Matsumoto, Nishida, and Watanabe are combinable because they are all concerned with image processing methods for modeling an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the refining process of Matsumoto and Nishida so that it includes the steps taught by Watanabe. The suggestion/motivation for doing so would have been to enhance the precision of the three-dimensional model (Watanabe page 1, paragraphs 7-10). Therefore, it would have been obvious to combine Matsumoto and Nishida with Watanabe to obtain the invention as specified in claim 1.

Referring to claim 2, Matsumoto discloses a method for constructing a 3D model of an object from a series of photographic images of the object, where the series of photographic images have been captured from a plurality of different angles, where the angle associated with each image is determined from a pre-selected reference point in three-dimensional space and where the image is comprised of a plurality of pixels (col. 15, lines 25-67, col. 16, line 65-col. 17, line 3 and figures 1 and 6), the method comprising the steps of:

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a. processing each photographic image to identify clusters of pixels in the image that describe the object (col. 17, lines 2-27 and figure 6);

b. tracing the perimeter of each cluster of the pixels in the image that describe the object to gather a set of pixels which describe the a silhouette contour of the object's shape, and thereby create a set of silhouette contours (col. 17, lines 2-27 and figure 6).

Matsumoto does not explicitly disclose the step of processing the points of the silhouette contours to select from those points the vertices of a polygon which approximates the silhouette contour of the object's shape, and thereby create a set of silhouette contour polygons. However, this feature was exceedingly well known in the art. For example, Nishida discloses the step of processing points of a silhouette contour to select from those points the vertices of a polygon which approximates the silhouette contour of an object's shape (col. 18, lines 19-41 and figures 8-10).

Matsumoto and Nishida are combinable because they are both concerned with image processing methods for determining a contour image of an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the silhouette contours of Matsumoto so that a polygon which approximates the silhouette contour of the object's shape is created, as taught by Nishida. The suggestion/motivation for doing so would have been to provide a compact expression of the structural features of the contour of the object, thereby enhancing the efficiency of the image processing method. Therefore, it would have been obvious to combine Matsumoto with Nishida.

Matsumoto further discloses the step of creating an initial three-dimensional model of the object using one of the silhouette contours, the three-dimensional model being formed by making

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a conical projection from one of the set of silhouette contours, creating along the bounds of the conical projection a near and far face for the object model, with the near and far faces each representing a projection of the vertices of the silhouette contour in three-dimensional space (col. 17, line 29-col. 18, line 10 and figures 7-8). In view of the combination described above, Matsumoto and Nishida disclose an initial three-dimensional model of the object that is based on the projection of one of the silhouette contour polygons. Accordingly, the initial three-dimensional model of the object comprises a plurality of polygonal faces.

Matsumoto further discloses the step of refining the initial three-dimensional model (col. 18, lines 3-47 and figure 9), but does not explicitly disclose that the refining process includes the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane of image collection for given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour polygons for the given image. However, the claimed refining process is not considered to be patently distinct from Matsumoto's refining process because both refining processes appear to be functionally equivalent. For example, Matsumoto explains that the initial three-dimensional model is refined by a (second) projection of a selected silhouette onto the initial model, wherein any portions of model that do not intersect the volume formed by the second projection are removed (col. 18, lines 10-26 and figure 9). Note that the steps described above in Matsumoto's refining process are functionally equivalent to the steps of projecting the initial three-dimensional model onto the two-dimensional plane for the selected silhouette, and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image--both refining processes result in the

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removal of any portions of the initial three-dimensional model that do not intersect the volume formed by the second projection of the selected silhouette onto the model. The applicant's specification provides further evidence of the functional equivalence described above. For example, on page 62, the applicants state:

“To refine the initial, (rough) 317 model depicted at 690 based on the second silhouette contour polygon 694, the system and method of the present invention uses a procedure (described in further detail below) that in effect projects the initial (rough) 3D model depicted at 690 through a conical projection of the second silhouette 694. The system then adjusts the initial, (rough) 317 model depicted at 690, clipping from the model those areas that do not intersect the volume formed by the second projection.”

Matsumoto clearly discloses these steps for his refining process (col. 18, lines 3-47 and figure 9). Accordingly, it appears that the results of Matsumoto's refining process are equivalent to the results of the claimed refining process, and therefore, the two refining processes are not considered patently distinct.

Despite the functional equivalence between the two refining processes, the Examiner notes that Matsumoto and Nishida still do not explicitly disclose the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane of image collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour polygons for the given image. However, these features were exceedingly well known in the art. For example, Watanabe discloses a three-dimensional model refining process that includes the steps of

projecting each face of an initial three-dimensional model of an object onto a two-dimensional plane of image collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image (page 4, paragraphs 43, 53 and page 5, paragraph 58).

Matsumoto, Nishida, and Watanabe are combinable because they are all concerned with image processing methods for modeling an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the refining process of Matsumoto and Nishida so that it includes the steps taught by Watanabe. The suggestion/motivation for doing so would have been to enhance the precision of the three-dimensional model (Watanabe page 1, paragraphs 7-10). Therefore, it would have been obvious to combine Matsumoto and Nishida with Watanabe to obtain the invention as specified in claim 2.

Referring to claim 3, Matsumoto discloses a method for constructing a 3D model of an object from a series of photographic images of the object, where the series of photographic images have been captured from a plurality of different angles about the object, where the angle associated with each image is determined from a pre-selected reference point in three-dimensional space and where the image is comprised of a plurality of pixels (col. 15, lines 25-67, col. 16, line 65-col. 17, line 3 and figures 1 and 6), the method comprising the step of:

a. processing each photographic image to identify those clusters of pixels in the image that describe the object (col. 17, lines 2-27 and figure 6).

Matsumoto does not explicitly disclose the step of processing those clusters of pixels which describe the object and select from those points the vertices of a polygon which approximates a silhouette contour describing the object's shape, and thereby creating a set of

silhouette contour polygons. However, this feature was exceedingly well known in the art. For example, Nishida discloses the step of processing clusters of pixels which describe an object and select from those points the vertices of a polygon which approximates a silhouette contour describing the object's shape (col. 18, lines 19-41 and figures 8-10).

Matsumoto and Nishida are combinable because they are both concerned with image processing methods for determining a contour image of an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method of Matsumoto so that a polygon which approximates a silhouette contour of the object's shape is created based on the clusters of pixels that describe the object, as taught by Nishida. The suggestion/motivation for doing so would have been to provide a compact expression of the structural features of the contour of the object, thereby enhancing the efficiency of the image processing method. Therefore, it would have been obvious to combine Matsumoto with Nishida.

Matsumoto further discloses the step of creating an initial three-dimensional model of the object using one of the silhouette contours, the three-dimensional model being formed by making a conical projection from one of the set of silhouette contours, creating along the bounds of the conical projection a near and far face for the object model, with the near and far faces each representing a projection of the vertices of the silhouette contour in three-dimensional space (col. 17, line 29-col. 18, line 10 and figures 7-8). In view of the combination described above, Matsumoto and Nishida disclose an initial three-dimensional model of the object that is based on the projection of one of the silhouette contour polygons. Accordingly, the initial three-dimensional model of the object comprises a plurality of polygonal faces.

Matsumoto further discloses the step of refining the initial three-dimensional model (col. 18, lines 3-47 and figure 9), but does not explicitly disclose that the refining process includes the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane of image collection for given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour polygons for the given image. However, the claimed refining process is not considered to be patently distinct from Matsumoto's refining process because both refining processes appear to be functionally equivalent. For example, Matsumoto explains that the initial three-dimensional model is refined by a (second) projection of a selected silhouette onto the initial model, wherein any portions of model that do not intersect the volume formed by the second projection are removed (col. 18, lines 10-26 and figure 9). Note that the steps described above in Matsumoto's refining process are functionally equivalent to the steps of projecting the initial three-dimensional model onto the two-dimensional plane for the selected silhouette, and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image--both refining processes result in the removal of any portions of the initial three-dimensional model that do not intersect the volume formed by the second projection of the selected silhouette onto the model. The applicant's specification provides further evidence of the functional equivalence described above. For example, on page 62, the applicants state:

"To refine the initial, (rough) 317 model depicted at 690 based on the second silhouette contour polygon 694, the system and method of the present invention uses a procedure (described in further detail below) that in effect projects the

initial (rough) 3D model depicted at 690 through a conical projection of the second silhouette 694. The system then adjusts the initial, (rough) 317 model depicted at 690, clipping from the model those areas that do not intersect the volume formed by the second projection.”

Matsumoto clearly discloses these steps for his refining process (col. 18, lines 3-47 and figure 9). Accordingly, it appears that the results of Matsumoto’s refining process are equivalent to the results of the claimed refining process, and therefore, the two refining processes are not considered patently distinct.

Despite the functional equivalence between the two refining processes, the Examiner notes that Matsumoto and Nishida still do not explicitly disclose the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane of image collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour polygons for the given image. However, these features were exceedingly well known in the art. For example, Watanabe discloses a three-dimensional model refining process that includes the steps of projecting each face of an initial three-dimensional model of an object onto a two-dimensional plane of image collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image (page 4, paragraphs 43, 53 and page 5, paragraph 58).

Matsumoto, Nishida, and Watanabe are combinable because they are all concerned with image processing methods for modeling an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the refining process of Matsumoto

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and Nishida so that it includes the steps taught by Watanabe. The suggestion/motivation for doing so would have been to enhance the precision of the three-dimensional model (Watanabe page 1, paragraphs 7-10). Therefore, it would have been obvious to combine Matsumoto and Nishida with Watanabe to obtain the invention as specified in claim 3.

Referring to claim 4, Matsumoto discloses a method for constructing a 3D model of an object from a plurality of two-dimensional contours comprised of pixels that describe the boundaries of the object, with each of the plurality of two-dimensional contours representing a view of the object from a different angle, where the angle associated with each contour being determined from a pre-selected reference point in three-dimensional space (col. 15, lines 25-67, col. 16, line 65-col. 17, line 3 and figures 1 and 6), the method comprising the step of processing the plurality of contours which describe the object.

Matsumoto does not explicitly disclose the step of selecting from the points of each contour the vertices of a polygon which approximates a contour describing the object's shape, and thereby creating a set of silhouette contour polygons. However, this feature was exceedingly well known in the art. For example, Nishida discloses the step of processing points of a contour which describe an object to select from those points the vertices of a polygon which approximates the silhouette contour of the object's shape (col. 18, lines 19-41 and figures 8-10).

Matsumoto and Nishida are combinable because they are both concerned with image processing methods for determining a contour image of an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the contours of Matsumoto so that a polygon which approximates the silhouette contour of the object's shape is created, as taught by Nishida. The suggestion/motivation for doing so would have been to

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provide a compact expression of the structural features of the contour of the object, thereby enhancing the efficiency of the image processing method. Therefore, it would have been obvious to combine Matsumoto with Nishida.

Matsumoto further discloses the step of creating an initial three-dimensional model of the object using one of the silhouette contours, the three-dimensional model being formed by making a conical projection from one of the set of silhouette contours, creating along the bounds of the conical projection a near and far face for the object model, with the near and far faces each representing a projection of the vertices of the silhouette contour in three-dimensional space (col. 17, line 29-col. 18, line 10 and figures 7-8). In view of the combination described above, Matsumoto and Nishida disclose an initial three-dimensional model of the object that is based on the projection of one of the silhouette contour polygons. Accordingly, the initial three-dimensional model of the object comprises a plurality of polygonal faces.

Matsumoto further discloses the step of refining the initial three-dimensional model (col. 18, lines 3-47 and figure 9), but does not explicitly disclose that the refining process includes the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane which also contains a projection of one of the two-dimensional silhouette contour polygons and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the projected silhouette contour polygon. However, the claimed refining process is not considered to be patently distinct from Matsumoto's refining process because both refining processes appear to be functionally equivalent. For example, Matsumoto explains that the initial three-dimensional model is refined by a (second) projection of a selected silhouette onto the initial model, wherein any portions of model that do not intersect

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the volume formed by the second projection are removed (col. 18, lines 10-26 and figure 9).

Note that the steps described above in Matsumoto's refining process are functionally equivalent to the steps of projecting the initial three-dimensional model onto the two-dimensional plane which also contains a projection of one of the two-dimensional silhouette contour polygons and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the projected silhouette contour --both refining processes result in the removal of any portions of the initial three-dimensional model that do not intersect the volume formed by the second projection of the selected silhouette onto the model. The applicant's specification provides further evidence of the functional equivalence described above. For example, on page 62, the applicants state:

“To refine the initial, (rough) 317 model depicted at 690 based on the second silhouette contour polygon 694, the system and method of the present invention uses a procedure (described in further detail below) that in effect projects the initial (rough) 3D model depicted at 690 through a conical projection of the second silhouette 694. The system then adjusts the initial, (rough) 317 model depicted at 690, clipping from the model those areas that do not intersect the volume formed by the second projection.”

Matsumoto clearly discloses these steps for his refining process (col. 18, lines 3-47 and figure 9). Accordingly, it appears that the results of Matsumoto's refining process are equivalent to the results of the claimed refining process, and therefore, the two refining processes are not considered patently distinct.

Despite the functional equivalence between the two refining processes, the Examiner notes that Matsumoto and Nishida still do not explicitly disclose the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane which also contains a projection of one of the two-dimensional contour polygons and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the projected silhouette contour. However, these features were exceedingly well known in the art. For example, Watanabe discloses a three-dimensional model refining process that includes the steps of projecting each face of an initial three-dimensional model of an object onto a two-dimensional plane which also contains a projection of one of a two-dimensional contour and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the projected silhouette contour (page 4, paragraphs 43, 53 and page 5, paragraph 58).

Matsumoto, Nishida, and Watanabe are combinable because they are all concerned with image processing methods for modeling an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the refining process of Matsumoto and Nishida so that it includes the steps taught by Watanabe. The suggestion/motivation for doing so would have been to enhance the precision of the three-dimensional model (Watanabe page 1, paragraphs 7-10). Therefore, it would have been obvious to combine Matsumoto and Nishida with Watanabe to obtain the invention as specified in claim 4.

Referring to claim 9, Matsumoto discloses a method for constructing a 3D model of an object from a plurality of two-dimensional contours comprised of pixels that describe the boundaries of the object, with each of the plurality of two-dimensional contours representing a

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view of the object from a different angle, where the angle associated with each contour being determined from a pre-selected reference point in three-dimensional space (col. 15, lines 25-67, col. 16, line 65-col. 17, line 3 and figures 1 and 6), the method comprising the step of processing the plurality of contours which describe the object.

Matsumoto does not explicitly disclose the step of selecting from the points of each contour the vertices of a polygon which approximates a contour describing the object's shape, and thereby creating a set of silhouette contour polygons. However, this feature was exceedingly well known in the art. For example, Nishida discloses the step of processing points of a contour which describe an object to select from those points the vertices of a polygon which approximates the silhouette contour of the object's shape (col. 18, lines 19-41 and figures 8-10).

Matsumoto and Nishida are combinable because they are both concerned with image processing methods for determining a contour image of an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the contours of Matsumoto so that a polygon which approximates the silhouette contour of the object's shape is created, as taught by Nishida. The suggestion/motivation for doing so would have been to provide a compact expression of the structural features of the contour of the object, thereby enhancing the efficiency of the image processing method. Therefore, it would have been obvious to combine Matsumoto with Nishida.

Matsumoto further discloses the step of creating an initial three-dimensional model of the object using one of the silhouette contours, the three-dimensional model being formed by making a conical projection from one of the set of silhouette contours, creating along the bounds of the conical projection a near and far face for the object model, with the near and far faces each

representing a projection of the vertices of the silhouette contour in three-dimensional space (col. 17, line 29-col. 18, line 10 and figures 7-8). In view of the combination described above, Matsumoto and Nishida disclose an initial three-dimensional model of the object that is based on the projection of one of the silhouette contour polygons. Accordingly, the initial three-dimensional model of the object comprises a plurality of polygonal faces.

Matsumoto further discloses the step of refining the initial three-dimensional model (col. 18, lines 3-47 and figure 9) and creating a triangulated mesh model from the refined three-dimensional model of the object (figure 6D), but does not explicitly disclose that the refining process includes the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane which also contains a projection of one of the two-dimensional silhouette contour polygons and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the projected silhouette contour polygon. However, the claimed refining process is not considered to be patently distinct from Matsumoto's refining process because both refining processes appear to be functionally equivalent. For example, Matsumoto explains that the initial three-dimensional model is refined by a (second) projection of a selected silhouette onto the initial model, wherein any portions of model that do not intersect the volume formed by the second projection are removed (col. 18, lines 10-26 and figure 9). Note that the steps described above in Matsumoto's refining process are functionally equivalent to the steps of projecting the initial three-dimensional model onto the two-dimensional plane which also contains a projection of one of the two-dimensional silhouette contour polygons and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the projected silhouette contour --both refining processes

result in the removal of any portions of the initial three-dimensional model that do not intersect the volume formed by the second projection of the selected silhouette onto the model. The applicant's specification provides further evidence of the functional equivalence described above. For example, on page 62, the applicants state:

“To refine the initial, (rough) 317 model depicted at 690 based on the second silhouette contour polygon 694, the system and method of the present invention uses a procedure (described in further detail below) that in effect projects the initial (rough) 3D model depicted at 690 through a conical projection of the second silhouette 694. The system then adjusts the initial, (rough) 317 model depicted at 690, clipping from the model those areas that do not intersect the volume formed by the second projection.”

Matsumoto clearly discloses these steps for his refining process (col. 18, lines 3-47 and figure 9). Accordingly, it appears that the results of Matsumoto's refining process are equivalent to the results of the claimed refining process, and therefore, the two refining processes are not considered patently distinct.

Despite the functional equivalence between the two refining processes, the Examiner notes that Matsumoto and Nishida still do not explicitly disclose the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane which also contains a projection of one of the two-dimensional contour polygons and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the projected silhouette contour. However, these features were exceedingly well known in the art. For example, Watanabe discloses a three-dimensional model refining process that includes the

steps of projecting each face of an initial three-dimensional model of an object onto a two-dimensional plane which also contains a projection of one of a two-dimensional contour and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the projected silhouette contour (page 4, paragraphs 43, 53 and page 5, paragraph 58).

Matsumoto, Nishida, and Watanabe are combinable because they are all concerned with image processing methods for modeling an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the refining process of Matsumoto and Nishida so that it includes the steps taught by Watanabe. The suggestion/motivation for doing so would have been to enhance the precision of the three-dimensional model (Watanabe page 1, paragraphs 7-10). Therefore, it would have been obvious to combine Matsumoto and Nishida with Watanabe to obtain the invention as specified in claim 9.

Referring to claim 10, Matsumoto discloses a method for constructing a 3D model of an object from a series of photographic images of the object, where the series of photographic images have been captured from a plurality of different angles, where the angle associated image is determined from a pre-selected reference point in three-dimensional space and where the image is comprised of a plurality of pixels (col. 15, lines 25-67, col. 16, line 65-col. 17, line 3 and figures 1 and 6), the method comprising the steps of:

- a. processing each photographic image to identify those clusters of pixels in the image that describe the object (col. 17, lines 2-27 and figure 6);

b. tracing the perimeter of each cluster of the pixels in the image that describe the object to gather a set of pixels which describe a silhouette contour of the object's shape, and thereby create a set of silhouette contours (col. 17, lines 2-27 and figure 6).

Matsumoto does not explicitly disclose the step of processing the points of the silhouette contours to select from those points the vertices of a polygon which approximates the silhouette contour of the object's shape, and thereby create a set of silhouette contour polygons. However, this feature was exceedingly well known in the art. For example, Nishida discloses the step of processing points of a silhouette contour to select from those points the vertices of a polygon which approximates the silhouette contour of an object's shape (col. 18, lines 19-41 and figures 8-10).

Matsumoto and Nishida are combinable because they are both concerned with image processing methods for determining a contour image of an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the silhouette contours of Matsumoto so that a polygon which approximates the silhouette contour of the object's shape is created, as taught by Nishida. The suggestion/motivation for doing so would have been to provide a compact expression of the structural features of the contour of the object, thereby enhancing the efficiency of the image processing method. Therefore, it would have been obvious to combine Matsumoto with Nishida.

Matsumoto further discloses the step of creating an initial three-dimensional model of the object using one of the silhouette contours, the three-dimensional model being formed by making a conical projection from one of the set of silhouette contours, creating along the bounds of the conical projection a near and far face for the object model, with the near and far faces each

representing a projection of the vertices of the silhouette contour in three-dimensional space (col. 17, line 29-col. 18, line 10 and figures 7-8).

Matsumoto does not explicitly disclose the step of creating additional faces to span volume between the points of the near and far faces based on pairs of adjacent vertices in the near and far faces. However, Official notice is taken that the step of creating additional faces to span volume between the points of two faces based on pairs of adjacent vertices in the two faces was exceedingly well known in the art. Therefore, it would have been obvious to modify the method of Matsumoto and Nishida so that additional faces are created to span volume between the points of the near and far faces based on pairs of adjacent vertices in the near and far faces. The suggestion/motivation for doing so would have been to enhance the appearance of the initial three-dimensional model.

Matsumoto further discloses the step of refining the initial three-dimensional model (col. 18, lines 3-47 and figure 9), but does not explicitly disclose that the refining process includes the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane of image collection for given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour polygons for the given image. However, the claimed refining process is not considered to be patently distinct from Matsumoto's refining process because both refining processes appear to be functionally equivalent. For example, Matsumoto explains that the initial three-dimensional model is refined by a (second) projection of a selected silhouette onto the initial model, wherein any portions of model that do not intersect the volume formed by the second projection are removed (col. 18, lines 10-26 and figure 9). Note that the steps described above in

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Matsumoto's refining process are functionally equivalent to the steps of projecting the initial three-dimensional model onto the two-dimensional plane for the selected silhouette, and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image--both refining processes result in the removal of any portions of the initial three-dimensional model that do not intersect the volume formed by the second projection of the selected silhouette onto the model. The applicant's specification provides further evidence of the functional equivalence described above. For example, on page 62, the applicants state:

“To refine the initial, (rough) 317 model depicted at 690 based on the second silhouette contour polygon 694, the system and method of the present invention uses a procedure (described in further detail below) that in effect projects the initial (rough) 3D model depicted at 690 through a conical projection of the second silhouette 694. The system then adjusts the initial, (rough) 317 model depicted at 690, clipping from the model those areas that do not intersect the volume formed by the second projection.”

Matsumoto clearly discloses these steps for his refining process (col. 18, lines 3-47 and figure 9). Accordingly, it appears that the results of Matsumoto's refining process are equivalent to the results of the claimed refining process, and therefore, the two refining processes are not considered patently distinct.

Despite the functional equivalence between the two refining processes, the Examiner notes that Matsumoto and Nishida still do not explicitly disclose the steps of projecting each face of the initial three-dimensional model of the object onto the two-dimensional plane of image

collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour polygons for the given image. However, these features were exceedingly well known in the art. For example, Watanabe discloses a three-dimensional model refining process that includes the steps of projecting each face of an initial three-dimensional model of an object onto a two-dimensional plane of image collection for a given image and revising the set of vertices of the projected face so that it bounds the space which falls within the boundaries of the silhouette contour for the given image (page 4, paragraphs 43, 53 and page 5, paragraph 58).

Matsumoto, Nishida, and Watanabe are combinable because they are all concerned with image processing methods for modeling an object. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the refining process of Matsumoto and Nishida so that it includes the steps taught by Watanabe. The suggestion/motivation for doing so would have been to enhance the precision of the three-dimensional model (Watanabe page 1, paragraphs 7-10). Therefore, it would have been obvious to combine Matsumoto and Nishida with Watanabe to obtain the invention as specified in claim 10.

Referring to claim 17, see the rejection of at least claim 1 above. Matsumoto further discloses a system (130) that includes modules for performing the steps described above (col. 15, lines 25-59 and figures 3-4).

Referring to claim 18, see the rejection of at least claim 2 above. Matsumoto further discloses a computer-based system (130) that includes modules for performing the steps described above (col. 15, lines 25-59 and figures 3-4).

Referring to claim 19, see the rejection of at least claim 3 above. Matsumoto further discloses a system (130) that includes modules for performing the steps described above (col. 15, lines 25-59 and figures 3-4).

Referring to claim 20, see the rejection of at least claim 4 above. Matsumoto further discloses a computer-based system (130) that includes modules for performing the steps described above (col. 15, lines 25-59 and figures 3-4).

Referring to claim 25, see the rejection of at least claim 9 above. Matsumoto further discloses a computer-based system (130) that includes modules for performing the steps described above (col. 15, lines 25-59 and figures 3-4).

Referring to claim 26, see the rejection of at least claim 10 above. Matsumoto further discloses a system (130) that includes modules for performing the steps described above (col. 15, lines 25-59 and figures 3-4).

Allowable Subject Matter

7. Claims 5-8, 16, 21-24, 32 are allowed.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after

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the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Charles Kim whose telephone number is 571-272-7421. The examiner can normally be reached on Mon thru Thurs 8:30am to 6pm and alternating Fri 9:30am to 6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on 571-272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-272-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ck

October 17, 2005


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